Ionization potentials of multicharged ions of medium elements

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The available data [1] on the ionization potentials (energies) $I_{N_e}(Z)$ (eV) of the multicharged ions of some elements with atomic numbers $15 \leq Z \leq 54$ are considered in isoelectronic serries. The ionization energies in atomic units are analyzed by the quasi-classical method [2] of isolating the dependence on the atomic number using the function $e_{N_e}(\sigma)$:

$$\mathrm{e}_{N_e} = (I_{N_e}(Z)/E_h)\, Z^{-4/3}, \quad \sigma = \pi Z^{-1/3}. \tag{1}$$

Hear $E_h = 27.211\ 386$ eV is Hartree energy.
It is shown that these dependences are smooth curves well approximated by polynomials:

$$\lg \mathrm{e}_{N_e}(\sigma) = \sum_{i=0}^{i_{\max}} a_i^{(N_e)} \sigma^i. \tag{2}$$

Thus, it is possible to estimate the ion's ionization potentials in the considered range according to the formula

$$I_{N_e} = Z^{4/3} 10^{\lg e_{N_e}(\sigma)} E_h. \tag{3}$$

with an error of the order and less of one percent.

[1] Nist atomic spectra database (ver. 5.9)
URL `https://physics.nist.gov/asd`
[2] Shpatakovskaya G V 2019 *Phys.-Usp.* **62** 186–197